

CLAIMS

1. A fabrication method of a semiconductor integrated circuit device, comprising the steps of:

(a) forming an insulating film over a semiconductor substrate;

(b) after the step (a), inserting the semiconductor substrate into a deposition chamber of a first film forming apparatus;

(c) heating the inside of the deposition chamber; and

(d) after the step (c), forming a silicon film added with a conductive impurity over the insulating film by a chemical film forming method,

said step (c) comprising the sub-steps of:

(c1) heating the inside of the deposition chamber while keeping the inside of the deposition chamber at atmospheric pressure; and

(c2) after the sub-step (c1), heating the inside of the deposition chamber while adjusting the pressure inside of the deposition chamber to vacuum or not greater than atmospheric pressure,

wherein a time required for the sub-step (c1) is longer than a time required for the sub-step (c2).

2. A fabrication method of a semiconductor integrated circuit device, comprising the steps of:

(a) forming an insulating film over a semiconductor

substrate;

(b) after the step (a), inserting the semiconductor substrate into a deposition chamber of a first film forming apparatus;

(c) heating the inside of the deposition chamber; and

(d) after the step (c), forming a silicon film added with a conductive impurity over the insulating film by a chemical film forming method,

said step (c) comprising the sub-steps of:

(c1) heating the inside of the deposition chamber while keeping the inside of the deposition chamber at atmospheric pressure; and

(c2) after the sub-step (c1), heating the inside of the deposition chamber while adjusting a pressure inside of the deposition chamber to vacuum or not greater than atmospheric pressure,

wherein a time required for the sub-step (c1) is 0.1 time or greater but not greater than 13 times as long as a time required for the sub-step (c2).

3. A fabrication method of a semiconductor integrated circuit device, comprising the steps of:

(a) forming an insulating film over a semiconductor substrate;

(b) after the step (a), inserting the semiconductor substrate into a deposition chamber of a first film forming

apparatus;

(c) adjusting a pressure in the deposition chamber to vacuum or not greater than atmospheric pressure;

(d) after the step (c), forming a silicon film free of a conductive impurity over the insulating film by a chemical film forming method;

(e) after the step (d), heating the inside of the deposition chamber while adjusting a pressure inside of the deposition chamber to vacuum or not greater than atmospheric pressure; and

(f) after the step (e), forming a silicon film added with a conductive impurity over the silicon film by a chemical film forming means,

wherein a time required for the step (c) is shorter than a time required for the step (e).

4. A fabrication method of a semiconductor integrated circuit device, comprising the steps of:

(a) forming an insulating film over a semiconductor substrate;

(b) after the step (a), forming a silicon film free of a conductive impurity over the insulating film by a chemical film forming method by using a second film forming apparatus; and

(c) after the step (b), forming a silicon film added with a conductive impurity over the silicon film by a

chemical film forming means by using a first film forming apparatus.

5. A fabrication method of a semiconductor integrated circuit device, comprising the steps of:

(a) forming an insulating film over a semiconductor substrate;

(b) after the step (a), inserting the semiconductor substrate into a deposition chamber of a first film forming apparatus;

(c) heating the semiconductor substrate while maintaining a pressure in the deposition chamber at atmospheric pressure;

(d) after the step (c), reducing the pressure in the deposition chamber to vacuum or not greater than atmospheric pressure while heating the semiconductor substrate; and

(e) forming a semiconductor film added with a conductive impurity over the insulating film by a chemical film forming method while maintaining the pressure in the deposition chamber at vacuum or not greater than atmospheric pressure,

wherein in the step (c), heating is conducted to increase a temperature of the semiconductor substrate to a first temperature of the semiconductor substrate upon formation of the semiconductor film or heating is conducted

to bring a temperature of the semiconductor substrate close to the first temperature.

6. A fabrication method of a semiconductor integrated circuit device, comprising the steps of:

(a) forming an insulating film over a semiconductor substrate;

(b) after the step (a), inserting the semiconductor substrate into a deposition chamber of a first film forming apparatus;

(c) heating the semiconductor substrate while maintaining a pressure in the deposition chamber at atmospheric pressure;

(d) after the step (c), reducing the pressure in the deposition chamber to vacuum or not greater than atmospheric pressure while heating the semiconductor substrate; and

(e) forming a semiconductor film added with a conductive impurity over the insulating film by a chemical film forming method while maintaining the pressure in the deposition chamber at vacuum or not greater than atmospheric pressure,

wherein a plurality of the semiconductor substrates are disposed in the deposition chamber, the deposition chamber is a vertical one in which the plurality of the semiconductor substrates are arranged vertically, and in

the step (c), heating is conducted to increase a temperature of the semiconductor substrate to a first temperature of the semiconductor substrate upon formation of the semiconductor film or heating is conducted to bring a temperature of the semiconductor substrate close to the first temperature.

7. A fabrication method of a semiconductor integrated circuit device according to Claim 6,

wherein in the step (c), a first semiconductor substrate having the lowest temperature among the plurality of the semiconductor substrates placed in the deposition chamber is heated to the first temperature of the semiconductor substrate upon formation of the semiconductor film or the first semiconductor substrate is heated to bring a temperature thereof close to the first temperature.

8. A fabrication method of a semiconductor integrated circuit device, comprising the steps of:

(a) forming an insulating film over a semiconductor substrate;

(b) after the step (a), inserting the semiconductor substrate into a deposition chamber of a first film forming apparatus;

(c) heating the semiconductor substrate to a first temperature while maintaining the inside of the deposition chamber at first pressure;

(d) after the step (c), reducing the pressure in the deposition chamber to be not greater than a second pressure, while heating the semiconductor substrate; and

(e) forming, over the insulating film of the semiconductor substrate heated to the first temperature, a silicon film added with a conductive impurity by a chemical film forming method while maintaining the pressure inside of the deposition chamber at vacuum or a third pressure not greater than atmospheric pressure,

wherein in the step (d), pressure is reduced so that the second pressure becomes lower than the third pressure, and

wherein in the step (c), the first pressure is higher than the third pressure.

9. A fabrication method of a semiconductor integrated circuit device, comprising the steps of:

(a) forming an insulating film over a semiconductor substrate;

(b) after the step (a), inserting the semiconductor substrate into a deposition chamber of a first film forming apparatus;

(c) heating the semiconductor substrate while keeping the inside of the deposition chamber at a first pressure,

(d) after the step (c), reducing the pressure in the deposition chamber to be not greater than a second pressure,

while heating the semiconductor substrate; and

(e) forming a silicon film added with a conductive impurity over the insulating film by a chemical film forming method while keeping the pressure in the deposition chamber at vacuum or a third pressure not greater than atmospheric pressure,

wherein in the step (d), pressure is reduced so that the second pressure becomes lower than the third pressure, and

wherein in the step (c), the semiconductor substrate is heated to bring a temperature thereof close to the first temperature while maintaining the first pressure to be higher than the third pressure.

10. A fabrication method of a semiconductor integrated circuit device according to Claim 9, wherein a time required for the step (c) is longer than that required for the step (d).

11. A fabrication method of a semiconductor integrated circuit device according to Claim 9, wherein the time required for the step (c) is 0.1 time or greater but not greater than 13 times as long as the time required for the step (d).

12. A fabrication method of a semiconductor integrated circuit device according to Claim 9,

wherein a plurality of the semiconductor substrates

are disposed in the deposition chamber, the deposition chamber is a vertical chamber in which the plurality of the semiconductor substrates are arranged vertically, and in the step (c), the first semiconductor substrate having the lowest temperature among the plurality of the semiconductor substrates disposed in the deposition chamber is heated to a first temperature of the semiconductor substrate upon formation of the semiconductor film or heated to bring the temperature of the first semiconductor substrate close to the first temperature.

13. A fabrication method of a semiconductor integrated circuit device according to Claim 9, wherein the first pressure is atmospheric pressure.